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ABSTRACT:

A paper making machine has a forming section (1 13), a press section (14 23) and a dryer section (24 30) each of which includes a multiple jet shower head assembly (32, 33, 34, 35) for conditioning the fabric, felt or screen of the section. Associated with each shower head assembly is a sensor (34) for sensing the condition of the fabric, felt or screen. The sensor (34) is linked to a computer (35) which controls the rate of traverse of the shower head assembly across the width of the fabric, felt or screen and the number of the jets in the head to be brought into use when the sensor indicates that conditioning is required to restore the condition of the fabric, felt or screen. Showering continues under the control of the computer in accordance with the sensed condition to maintain the fabric, felt or screen in an optimum condition



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54 Improvements in and relating to paper making machines.

(57) A paper making machine has a forming section (113), a press section (14 23) and a dryer section (24 30) each of which includes a multiple jet shower head assembly (32, 33, 34, 35) for conditioning the fabric, felt or screen of the section. Associated with each shower head assembly is a sensor (34) for sensing the condition of the fabric, felt or screen. The sensor (34) is linked to a computer (35) which controls the rate of traverse of the shower head assembly across the width of the fabric, felt or screen and the number of the jets in the head to be brought into use when the sensor indicates that conditioning is required to restore the condition of the fabric, felt or screen. Showering continues under the control of the computer in accordance with the sensed condition to maintain the fabric, felt or screen in an optimum condition

EP 0 383 486 A2

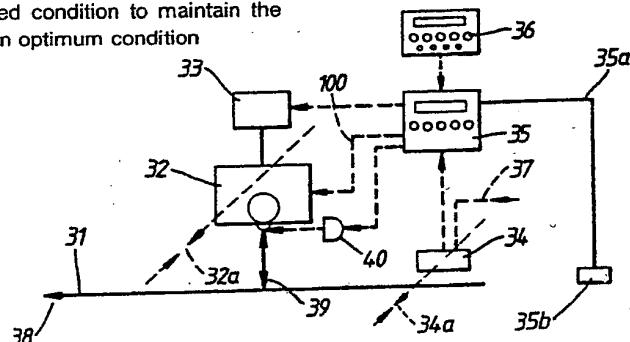


Fig. 4.

Improvements in and relating to paper making machines

This invention relates to paper making machines and has particular reference to the construction of a shower installation for the machine and the method of operating the latter.

Oscillating high pressure needle jet water showers are widely used in paper making machinery to maintain the openness and cleanliness of the forming fabrics in the forming section, of the press felts in the press section and of the dryer fabrics or screens in the dryer section of the machine. The shower commonly comprises a pressure tube or pipe with multiple needle jets which is oscillated, normally in accordance with the distance between the jets or in multiples of that distance, across the fabric, felt or screen to open, maintain the bulk of, and assist to clean the latter and maintain it in optimum condition. Alternatively, the shower may comprise a head with a single jet which is traversed across the full width of the fabric, felt or screen. The shower tube, pipe or head may be driven across the fabric, felt or screen by a pneumatic or hydraulic actuator or by an electromechanical drive unit.

As is well known, the fabric, felt or screen is typically subjected to changing operational conditions throughout its working life. This applies particularly to the press felt which is also subjected to the pressures applied in the press section and commonly results in a gradual compaction of the felt taking place and causing a gradual deterioration of the condition of the felt resulting in increasing difficulty in the removal of felt contaminants and a reduction in the water handling capacity of the felt. As the felt compacts, its permeability decreases so that higher vacuum levels will be reached in the felt conditioning box resulting in increased felt wear and increased difficulty in extracting water from the felt. As the felt permeability decreases, an increased application of force from the needle jet shower is needed to restore the bulk of the felt and to allow contaminants to be removed.

It is generally accepted that the use of high pressure needle jet showers is the best way of maintaining the fabric, felt or screen in optimum condition. To clean or overcome compaction, a predetermined jet pressure must be used and the shower must be brought into use sufficiently often and for such periods that, dependent upon the condition of the fabric, felt or screen, the optimum condition is maintained. All areas of the fabric, felt or screen must be subjected to even showering to avoid excessive showering over some areas and insufficient showering over other areas which would result in a fabric, felt or screen with uneven water

handling capacity. Hence, the speed at which the shower jets traverse across the fabric, felt or screen is an important factor in effective showering.

It is common practice for showering to take place several times during each time period or shift that the paper making machine is in use and to shower for a period of time thought to be sufficient to restore the fabric, felt or screen to an acceptable condition. This means that ideally every single point of the fabric, felt or screen will have been subjected to the jet pressure several times within a period sufficient to restore the condition of the fabric, felt or screen but not enough to damage it.

However, the common practice of periodically showering with a multi-jet shower - necessary to avoid the potential damage, particularly of the felt, that would result from continuous use - results in the condition of the fabric, felt or screen gradually deteriorating between the times that the shower is in use. It may also result in the shower standing idle for relatively long periods. This is because, in a conventional multi-jet shower design, the number of jets installed and, thus the distance between those jets will be based upon the likely maximum force required under the most adverse conditions. It then follows that, under normal conditions, the shower capacity is over-rated. To avoid damage to the fabric, felt or screen, the shower is then operated intermittently. Such intermittent operation becomes highly subjective and the fabric, felt or screen is commonly not maintained in optimum condition.

What is, therefore, required is a shower installation that will respond automatically to the varying needs of the paper making machine and the fabric, felt or screen and which will maintain the latter in optimum condition at all times, thus providing a higher and more constant operating performance throughout its life.

According to the present invention a paper making machine comprises a multi-jet shower head, a drive system for traversing the head across the machine fabric, felt or screen, a condition sensor for sensing the condition of the fabric, felt or screen, and a control arrangement for bringing the shower head and the drive system into operation to traverse the head across the fabric, felt or screen when the sensor indicates that the fabric, felt or screen had reached a predetermined condition, the shower head being traversed at a rate and with a sufficient number of jets in use to restore the condition to the optimum value and thereafter at a rate and with an appropriate number of jets sufficient to maintain the optimum condition.

In an alternative form of the present invention, a shower installation for a paper making machine

comprises a multi-jet shower head, a drive system for traversing the head across the fabric, felt or screen, and a control arrangement for bringing the shower head and the drive system into operation to traverse the shower head across the fabric, felt or screen when the condition thereof indicates a need for a change in the showering conditions required, the shower head being traversed at a rate and with a sufficient number of jets to maintain the fabric, felt or screen in a required condition.

Preferably, the control means is supplied with information defining the speed of the fabric, felt or screen through the machine and this, together with information on the fabric, felt or screen length, will determine the rate of traverse of the shower head per jet.

In one embodiment of the invention, the shower head includes pressure control means settable by the control arrangement to determine the pressure of liquid supplied to the jets of the shower head.

The shower head may include a number of jets each of which may be brought into use independently of the others. In that case, the control arrangement will also determine the number of jets to be brought into use for a showering operation and will automatically relate that requirement to the rate of traverse of the shower head.

The control arrangement may comprise a computer or it may comprise a read-only memory. The control arrangement may also comprise a membrane keyboard with a multi-function alpha-numeric display and may have the capability of computing inputs and of determining operational requirements as an independent function, or the control arrangement may be integrated with a paper machine main computer.

By way of example only, an embodiment of the invention will now be described in greater detail with reference to the accompanying drawings of which:-

Fig. 1 is a schematic side view of a typical forming section of a paper making machine.

Fig. 2 is a schematic side view of a typical press section of the machine.

Fig. 3 is a schematic view of a typical dryer section of the machine.

Fig. 4 is a block schematic drawing of a shower installation for a paper machine embodying the invention.

Fig. 5 is a schematic drawing of a part of the machine.

Fig. 6 is a schematic drawing of another form of a part of the machine.

Fig. 7 is a schematic drawing of another form of a part of the machine.

Fig. 8 is an explanatory diagram to illustrate traversal of the shower head, and,

Fig. 9 is an explanatory diagram of a multiple jet block layout.

Fig. 1 which is an explanatory side view of a typical forming section of a paper making machine shows a flow box 1 from which slurry is fed via a slice 2 on to the upper surface of the forward run of a forming fabric 3 movable in the direction of arrow 4. The slurry is conveyed by the forming fabric 3 over a series of drainage foils indicated diagrammatically at 5 which initiate the drainage of water from the slurry to form a wet sheet. The wet sheet is then carried over several vacuum foils indicated diagrammatically at 6 which remove further water from the wet sheet. The wet sheet then passes over a series of flat box draining devices indicated diagrammatically at 7.

The forming fabric 3 then passes over a couch roll 8 and a change direction or forward drive roll 9 to form the return run of the forming fabric. The wet sheet is lifted off the forming fabric by suitable means and passes to the press section of the machine as indicated by the dotted line 10.

The return run of the forming fabric is supported by a series of rollers 11 to a breast roll 12 beneath the flow box 1.

Before it reaches the breast roll 12, the forming fabric 3 is subjected to the action of high pressure water jets from a high pressure needle jet shower head indicated schematically by block 13. The jets loosen and remove contraries, for example pitch, in the structure of the forming fabric which is usually a woven monofilament plastics mesh. In addition, the jets assist in maintaining the openness or condition of the forming fabric. The shower head 13 is operated on an intermittent basis as required by the condition of the forming fabric.

As the wet sheet leaves the forming section, its solids content is about 20% by volume.

From the forming section, the wet sheet 10 passes into the press section typically as shown diagrammatically in Fig. 2 in which the wet sheet is carried by a press felt 14 to the nip of top and bottom press rolls 15, 16 which are pressed together by known means to extract further water from the wet sheet. It will be understood that the top and bottom press rolls 15, 16 may each comprise an assembly of rolls rather than the single rolls shown, and may include different roll surfaces from solid surfaces to open surfaces.

On emerging from the press rolls, the compacted wet sheet now having an increased solids content is fed off the press felt and passes through additional press sections to the dryer section of the machine shown diagrammatically in Fig. 3.

The path of the press felt 14 is indicated diagrammatically in Fig. 2. It passes in a closed loop supported by guide rollers 17 and a tensioning roller 18.

To maintain the condition of the press felt, it is subjected to the action of high pressure needle water jets. First, there is the conventional shower head installation indicated schematically at 19. Adjacent the installation 19 is a low pressure shower head indicated schematically at 20. Shower 20 is also of conventional design and will usually be a stationary installation.

The function of shower head installation 19 is to loosen the structure of the press felt and so "bulk-up" or condition the felt which has suffered a degree of compaction during passage through the press rolls. Loosening the felt structure will permit the removal from the felt of impurities, for example fibres, clay particles, etc., by later treatment.

Removal of impurities is effected by a vacuum box section indicated diagrammatically at 21. Associated with the vacuum box section 21 is a low volume, low pressure shower head indicated at 22 which supplies a limited quantity of water to the press felt to provide lubrication between the felt and the surface of the vacuum box section 21. The shower head 22 is, of course, upstream of the vacuum box section 21 in the direction of movement of the press felt as indicated by the arrow head 23.

From the press section of Fig. 2, the wet sheet 24 passes to a dryer section as shown in Fig. 3 where it passes over steam-heated drying cylinders of which three are shown in Fig. 3 at 25. The wet sheet is conveyed through the dryer section supported by a dryer fabric or screen shown at 26 which moves through the section in the direction indicated by arrow head 27, being supported by rollers 28.

To remove contaminants from the structure of the dryer fabric or screen and restore its condition, a shower installation is provided as indicated at 29. Associated with the installation 29 and beneath the screen 26 is a tray 30 in which to collect the removed contaminants and water from the shower installation.

From the dryer section the dried sheet passes to other treatment processes as is well known.

Conventionally, the shower installations 13, 19 and 29 described above are high pressure needle jet water showers traversed across the width of the forming fabric, press felt or dryer screen by a suitable drive unit which may be pneumatic, hydraulic or electromechanical and are brought into use by an operator at usually arbitrarily chosen intervals. The result is that the condition of the fabric, felt or screen gradually deteriorates between the periods of use of the shower installations and the latter are standing idle for relatively long periods.

These defects are overcome by the present invention which recognises that to maintain the

fabric, felt or screen constantly in optimum condition, the shower installations must be operated continuously but in a manner that is determined by the condition of the fabric, felt or screen just upstream of the shower installations.

Fig. 4 shows, in diagrammatic form only, a shower head installation for a paper making machine embodying the invention.

Above a suitable point along the length of the fabric, felt or screen 31 shown travelling in direction of arrow head 38 is located a shower head represented in Fig. 4 by block 32. The shower head is supported, as indicated by dotted line 32a, in a manner that enables the head to be traversed across the width of the fabric, felt or screen by a suitable drive system represented in Fig. 4 by block 33. The drive system is a variable speed system able to traverse the head at any one of a number of different speeds.

The shower head accommodates a plurality of jets each of which, in use, directs a stream of water on to the surface of the fabric, felt or screen beneath the head. In Fig. 4, the water supply to the shower has been omitted. Each jet has a valve 40 or other flow control means associated with it and which opens or closes the water supply to the jet.

Located upstream of the head 32 and either below or above the fabric, felt or screen is a condition sensor shown as block 34 for sensing the condition of the fabric, felt or screen. The sensor senses the condition by sensing the permeability of a limited area of the fabric, felt or screen and is movable across its width as indicated by the dotted line 34a in order to sense the permeability at different areas across the width. The sensor may operate continuously while the machine is in use, or it may be controlled to operate intermittently.

The sensor 34 is a part of the shower head and is supported from the head in any suitable manner. The sensor is positioned upstream, in the direction of movement of the fabric, felt or screen through the machine, of the shower head and at a position clear of the area sprayed by the shower jets.

Alternatively, the sensor may be driven by an independent drive system shown schematically by line 34a, the drive system being controlled by the computer 35 to move the sensor independently of the shower head.

The permeability sensing is effected by the measurement of positive pressure air flow from a pressurised system and will be supplied by a controlled air input 37. The permeability sensor will be calibrated to relate to the common range of flow resistance of the fabric, felt or screen at the point at which the shower head is operating.

Signals representing the sensed permeability are transmitted by the sensor to a control arrangement shown in Fig. 4 as block 35 and which may

be a microcomputer or a read-only memory.

A sensor which projects a flow of air onto the paper making material carried on the fabric, felt or screen is shown in Fig. 5. A vertical tube 63 located above the fabric, felt or screen is connected at one end to the air line 37. Air flow control means are provided to control the flow of air through the tube 63. The position of the tube above the fabric, felt or screen is adjustable by means indicated diagrammatically at 64. Positioned within the tube 63 and exposed to the flow of air therethrough is a thermistor 65 or other suitable flow sensitive device that responds to changes in the rate of flow of air through the tube 63. Compensation is provided for changes in ambient temperatures which may otherwise affect the response of the thermistor. Thermistor 65 is electrically connected to the computer 35.

In Fig. 6, the shoes are shown located at one edge of 31, but it will be understood that they traverse across 31 and the paper making material thereon.

The sensor may be set to read the permeability across the width of the fabric, felt or screen and to input the readings to the computer, appropriate showering instructions being transmitted from the computer to the shower head. A mechanism for traversing the tube across the width of the fabric, felt or screen is indicated diagrammatically at 63a.

Alternatively, the sensor may be positioned to detect low permeability streaks in the fabric, felt or screen and then signal, via computer 35, the shower head to operate only within the area of the streaks until the sensed permeability falls to the general average of the fabric, felt or screen at which stage full width traversing of the shower will recommence.

In addition, control is exercised over the number of jets required to be brought into use and this is indicated schematically in Fig. 4 by the control line to valve 40 from computer 35.

Additionally, the pressure of water supplied to the jets may be varied if required. The use of too high a water pressure may cause the fabric, felt or screen to become damaged whilst too low a pressure will not improve the condition of the fabric, felt or screen. Such pressure control may be exercised by control means in the shower head itself or at a convenient point in a supply manifold feeding the head. Pressure is controlled from computer 35 as is indicated schematically in Fig. 4 by the line 100.

Computer 35 is also supplied with information relating to the speed of the fabric, felt or screen together with information defining the overall length of the fabric, felt or screen to determine the rate of traverse of the shower head 32 across the former. Such information is inputted as described below but additionally any speed changes that occur

while the paper making machine is in use are signalled to the computer along input 35a from a speed sensor indicated as block 35b.

Associated with the computer 35 is a keyboard

5 36 or the equivalent which enables an operator to signal to the computer 35 the information just referred to as well as the width of the fabric, felt or screen and to allow alterations to be made when required to accommodate a different length of fabric, felt or screen and changes in other variables.

10 Before use, the operator, using the keyboard 36, inputs to the computer 35 information representing the fabric, felt or screen width, its overall length and its speed. The sensor 34 is also set or zeroed to indicate the optimum condition of the fabric, felt or screen, this setting being referred to as the optimum value.

15 Tube 63 is also positioned so that its lower end is in contact with the paper making material on the fabric, felt or screen 31 when the machine is in use. In Fig. 5 such material is shown diagrammatically at 31a. The tube 63 may be lightly loaded resiliently to maintain close contact with the surface of the paper making material. The machine is then set into operation.

20 During the paper making process the fabric, felt or screen compacts and becomes loaded with impurities resulting in a decrease in its permeability and, as a consequence, the air flow through the tube 63 decreases. That decrease is detected by the thermistor 65 which signals it to the computer 35. When the decrease reaches a predetermined value - the first value - the computer responds and brings the drive system and the shower head is driven across the fabric, felt or screen. The speed of traverse is related to the first value. In addition, the computer, operating through the control valves 40 brings into use a number of the jets, the number also being related to the first value. The water pressure is also set to a suitable level.

25 The action of the jets opens the structure of the fabric, felt or screen and washes impurities from the latter. Opening the structure results in an increase in the permeability which is sensed by the sensor 34 and signalled to the computer 35. As a result, the speed of traverse of the shower is reduced, and, in relation, the number of jets in use is also reduced according to a preset program. That action continues until the permeability reaches a value indicating that the optimum condition has been reached. When that happens, the shower head is being traversed at minimum speed and with only one jet in use.

30 35 Thus as the condition restores to the optimum value, the showering is adjusted to maintain that optimum value.

35 If the sensed permeability and hence the condition of the fabric, felt or screen changes whilst

the machine is in use, the changes are signalled to the computer 35 which signals to the drive system to change the speed at which the shower head is traversed across the fabric, felt or screen, and, in relation, also changes the number of jets in use. The computer may also alter the pressure of water supplied to the jets. Those changes will be in accordance with the sensed changes in permeability. The number of jets in use may be changed in units of one or more according to a preset program between a minimum of one jet in use up to a maximum of all jets in use.

In that way, the fabric, felt or screen is continuously maintained in optimum condition and effective use is made of the showering equipment.

The speed of traverse of the shower head across the fabric, felt or screen will be related to the number of jets in use as well as to the nature of the machine fabric, felt or screen and the length of the latter. The speed input to the computer will normally be through a machine - computer interface.

With shower jets spaced from the surfaces of the fabric, felt or screen by a common distance of from 250 - 400 mm and with a common jet diameter of 1 mm, the diameter of the jet spray at the point of impact with that surface will be approximately 1.5 mm. It is thus usual to calculate a speed of movement of the shower head across the fabric, felt or screen of approximately 1.5 mm for each revolution of the fabric, felt or screen per jet that is in use. The jet pressure will be determined in accordance with specific application demands i.e. the type of fabric etc. structure.

The jet diameter and its spacing above the surface may be varied as may the speed of the head across the fabric, felt or screen.

The condition of the fabric, felt or screen may be detected by other forms of sensor than the permeability sensor. For example, the condition may be sensed by a sensor responsive to changes in the thickness of the fabric, felt or screen. Two forms of thickness sensor are shown schematically in Figs. 6 and 7.

In Fig. 6, a "shoe" 66 is positioned above the fabric, felt or screen 31 and within the limits of the paper making material 31a thereon. The position of the shoe is adjustable up and down with respect to the surface of the fabric, felt or screen 31 by any suitable means indicated by block 67. Another shoe 68 is located beneath 31 in a position aligned with that of shoe 66, and is also movable up and down by any suitable means indicated by block 69. Both shoes are resiliently loaded into contact with 31 and both have detectors which sense movement of the shoes from the position which they occupy when the fabric, felt or screen is in optimum condition.

If desired, both shoes may be movable in synchronism across the width of the fabric, felt or screen and thereby able to sense thickness changes at any lateral position across that width. Means for moving the shoes are indicated diagrammatically at 72.

5 The movement detectors are operatively connected to the computer 35 and they signal to the latter positional changes of the shoes. It will be appreciated that as paper making proceeds, the fabric, felt or screen compacts and thus decreases in thickness. That decrease is signalled to the computer 35 as positional changes of the shoes and the computer initiates showering as described above.

10 An alternative form of thickness sensor is shown diagrammatically in Fig. 7. A single shoe 70, similar to 66, is positioned above the fabric, felt or screen 31 and the material 31a thereon and a fixed support 71 is located beneath the fabric, felt or screen in a location aligned with the shoe 70 but extending across the entire width of the fabric, felt or screen. In this case, changes in thickness result in movement of shoe 70 only and such movements are sensed by a sensor in support 70a and are signalled to the computer 35. The operation of the Fig. 7 arrangement is otherwise generally similar to that of the arrangement shown in Fig. 6.

15 Additionally, shoe 70 may be fitted to a structure shown diagrammatically at 70b by which it is movable across the width of the fabric, felt or screen along a track directly above the fixed support 71. Such movement enables the shoe 70 to respond to thickness changes at locations across the width of the fabric, felt or screen.

20 As an alternative to needle jets, fan jets may be used, or a combination of needle and fan jets may be employed.

25 The jets may be supplied with water only, or with a mixture of air and water thereby producing "pulsed" water jets. Other liquids may be used in place of water and, if necessary, chemicals may be added to the water or other liquid.

30 Because jet orifices will normally be of about 1 mm diameter and because each jet normally requires a control valve, the distance between jets will be greater than the striking diameter of about 1.5 mm. This means that the jets will normally be installed in rows or spaced tangentially to provide sufficient clearance for the jet assembly control valves.

35 The total number of jets installed in the shower head assembly will be determined in accordance with the specific maximum requirements of the particular application on a continuous basis. Typically, the number will be between 4 and 20 jets mounted in the shower head assembly, but there will be applications requiring different numbers of

jets.

By way of example only, Fig. 8 shows, in an exaggerated manner, a shower head 41 traversing in a direction 42 across a fabric, felt or screen 47 itself travelling in a direction indicated by arrow 43. Ten jets 44 are shown and these sweep a width 45 of approximately 15 mm when striking the fabric, felt or screen at 46. The swept width 45 will be angled as shown in dependence upon the speed of the fabric, felt or screen 47, the number of jets 44 and the speed of traverse in direction 42 of the shower head 41. In addition, the parameters just mentioned are chosen so that adjacent swept strips as shown at 48 do not overlap and are not separated by unswept strips. By this method, each single traverse of the shower head 41 will clear the entire width of the fabric, felt or screen.

When the shower head 41 reaches the far edge of the fabric, felt or screen 50 with jet 51 being the end jet, the direction of movement of the shower 41 will be reversed and the condition or cleansing cycle will be repeated in the reverse direction across the fabric, felt or screen 47 until jet 62 reaches the point 63 when the direction of movement of the head is again reversed for a repeated sequence.

The method mounting the jets in the shower head assembly may be varied by different designs and arrangements. Either individual jets may be mounted in a diagonal block or in any other configuration or in one or more rows, or alternatively laser-cut blocks can be applied with integral or exterior shut-off valve facilities. The jets may also be installed in a replaceable block so that either worn jets can be replaced or blocks with different numbers of jets or jet sizes or orifices can be installed. In this latter arrangement the shower head can be parked at the front or back of the paper making machine and with a quick release mechanism the block could be changed and, where relevant, new instructions fed into the computer.

By way of example only, Fig. 9 shows in diagrammatic form a shower head assembly 52 in which are mounted ten jets 53 arranged in two diagonal columns for the purpose of providing space between jets to allow for nozzle assembly space and also to accommodate individual flow controllers. The space between the jet assemblies shown at 54 and 55 is significantly greater than the distance between the jets which is the actual separating distance between a straight row of 1 mm jets required to achieve full coverage at points of impact 57 due to the spread of the water jets 58 after they leave the orifices 53.

The block 52 is normally viewed in plan with the jets 53 jetting downwards on to the fabric, felt or screen travelling in direction of arrow 59 and impacting at points 57. The jet block 52 would be

moving in the direction of arrow 60 or 61 across the width of the fabric, felt or screen.

Thus, the distance 56 between jets must be related to the distance 62 to ensure that there is full coverage of distance 63 at the point of impact 57 with the fabric, felt or screen.

The means for determining permeability can be varied as determined above. However, where a traversing measuring sensor is used for the purpose of sensing permeability changes at one point only across the fabric, felt or screen then this sensor may be mounted upon the shower head and on the same side as the shower jets and commonly located ahead of the latter so that water would not interfere with the measurement. The permeability sensor face or surface would be constructed from a low friction type material, for example a ceramic material or a high density polyethylene according to the prevailing operating conditions on the paper making machine. Where a stationary sensor is sufficient for sensing changes in the full width permeability only this can be installed remotely from the shower head assembly. However, in such cases, it is also expected as, an alternative that a small sensor can be located in any convenient position within the width of sheet and on either side of the fabric, felt or screen.

It will be appreciated that, in an emergency, the condition of the fabric, felt or screen may be determined visually by an operator, in which case control over the rate of traverse and the number of jets will be set by the operator from block 36 so overriding the operation of the block 34.

It will also be understood that there may be circumstances in which not all the sections of the paper making machine will be fitted with shower head assemblies of the form described above with reference to Fig. 4, some of the sections may have shower head assemblies of conventional form. In most cases, however, the press section will have a shower head assembly of the form described above with reference to Fig. 4.

45 Claims

1. A paper making machine having a permeable conveyor belt for conveying paper making material through the machine during a paper making process, a multi-jet shower head for cleaning and conditioning the belt, and a drive system for moving the shower head forwards and backwards across the belt characterised in that, associated with the shower head is a condition sensor for sensing the condition of the belt at a location along the length of the belt, and a control system connected to the sensor for receiving therefrom signals indicative of the condition of the belt, the control

system also being operatively connected to the drive system and to the shower head to bring the drive system and the shower head into operation in accordance with the sensed condition of the belt, the shower head being traversed across the belt at a speed and with a number of jets sufficient to restore the cleanliness and condition of the belt, the shower head then being traversed at a speed and with a number of jets sufficient to maintain the cleanliness and condition of the belt.

2. A paper making machine having a permeable belt for conveying paper making material through the machine during a paper making process, a multi-jet shower head for cleaning and conditioning the belt, and a drive system for moving the shower head forwards and backwards across the belt characterised in that, associated with the shower head, is a condition sensor for sensing the condition of the belt at a location thereon, and a control system for bringing the shower head and the drive system into operation to traverse the shower head across the belt to clean and condition the latter when the condition sensor indicates that the condition of the belt has reached a value indicating that cleaning and conditioning are required, the shower head being traversed at a speed and with a number of jets sufficient to restore the cleanliness and condition of the belt, the shower head then being traversed at a speed and with a number of jets sufficient to maintain the cleanliness and condition of the belt.

3. A paper making machine as claimed in claim 1 or 2 characterised in that the condition sensor comprises a sensor for sensing and indicating the permeability of the belt.

4. A paper making machine as claimed in claim 1 or 2 characterised in that the condition sensor comprises a sensor for sensing the thickness of the belt.

5. A paper making machine as claimed in claim 3 characterised in that the permeability sensor comprises means for directing a stream of air onto the paper making material on the belt and a device responsive to the rate of flow of air through the air flow directing means.

6. A paper making machine as claimed in claim 4 characterised in that the thickness sensor comprises a shoe movable into contact with the paper making material on the belt, and a fixed shoe aligned with the movable shoe and in contact with an undersurface of the belt.

7. A paper making machine as claimed in any one of the preceding claims characterised in that the shower head comprises a plurality of shower jets each of some at least of which incorporates an individual flow control valve, and in that the control system is adapted to operate the flow control valves to determine the number of jets in use when

the shower is in operation.

8. A paper making machine as claimed in any one of the preceding claims characterised in that the drive system is a variable speed drive system for traversing the head across the belt at a speed set by the control system in accordance with signals received from the sensing arrangement.

9. A paper making machine as claimed in any one of the preceding claims characterised in that the shower head includes pressure adjusting means for adjusting the pressure of liquid supplied by the or some at least of the jets, and in that the control system is adapted to operate the pressure means in accordance with signals received from the sensor.

10. A paper making machine as claimed in any one of the preceding claims characterised in that support means are provided for supporting the sensor for traversing movement across the belt in synchronism with the shower head, the support means being located upstream of the shower head in the direction of movement of the belt.

11. A paper making machine as claimed in any one of the preceding claims characterised in that the sensor is fixed relatively to the machine and senses the condition of the belt at a fixed location.

12. A paper making machine as claimed in claim 10 characterised in that the sensor senses the condition of the belt across the width of the latter.

13. A paper making machine as claimed in any one of claims 1 to 10 characterised in that support means are provided for supporting the sensor for traversing movement across the belt, and in that the control system is adapted to control movement of the sensor independently of the shower head.

14. A paper making machine as claimed in any one of the preceding claims characterised in that means are provided for measuring the speed of movement of the belt and for signalling the measured speed to the control system and for indicating to the control system the overall length of the belt, the speed and length being used by the control means in the determination of the speed of traverse of the shower head.

15. A paper making machine as claimed in any one of the preceding claims characterised in that the control system comprises a microcomputer.

16. A paper making machine comprising in combination a permeable belt for conveying paper making material through the machine during operation thereof, a multi-jet shower head incorporating a plurality of shower jets, fluid flow control valves for each of some at least of the jets for controlling the flow of fluid through the jet, the shower head being positioned to direct streams of fluid towards the belt to clean and condition the latter, a drive system for traversing the head forwards and backwards

across the belt, condition sensing means located adjacent the belt for sensing the condition thereof and to provide output signals indicative of the sensed condition at a particular location, and a control system connected to receive the signals and, when the sensing means indicates that the condition of the belt is such that cleaning and condition are required, to control the drive means to traverse the shower head and to control the fluid flow control valves to determine the number of jets in use, the shower head being traversed at a speed and with a number of jets sufficient to restore the cleanliness and condition of the belt, the shower head then being traversed at a speed and with a number of jets sufficient to maintain the cleanliness and condition of the belt.

17. A paper making machine comprising in combination a forming section with a flow box for feeding slurry onto a forming fabric for conveying the slurry through the forming section over devices for removing water from the slurry, means for transferring the de-watered slurry from the forming fabric and passing it to a press section of the machine, the press section having a press felt for conveying the de-watered slurry through the press section, and press rolls between which the press felt passes and which form the de-watered slurry into wet sheet, means for lifting the wet sheet from the press felt and passing it onto a dryer screen which conveys the wet sheet through a dryer section of the machine, the dryer section comprising dryer cylinders over which the wet sheet supported on the dryer fabric passes to dry the wet sheet, at least one of the said sections including a multi-jet shower head for cleaning and conditioning the fabric, felt or screen by showering a fluid thereon, and a drive system for traversing the shower head across the fabric, felt or screen, a sensor associated with the shower head for sensing the and condition of the fabric, felt or screen and a control system connected to the sensor for receiving therefrom signals indicative of that condition, the control system also being connected to the drive system and the shower head to traverse the shower head and cause the latter to shower the fabric, felt or screen when the sensed condition indicates that cleaning and conditioning are required, the shower head being traversed at a speed and with a number of jets sufficient to restore the cleanliness and condition of the fabric, felt or screen, the shower head then being traversed at a speed and with a number of jets sufficient to maintain the cleanliness and condition of the belt.

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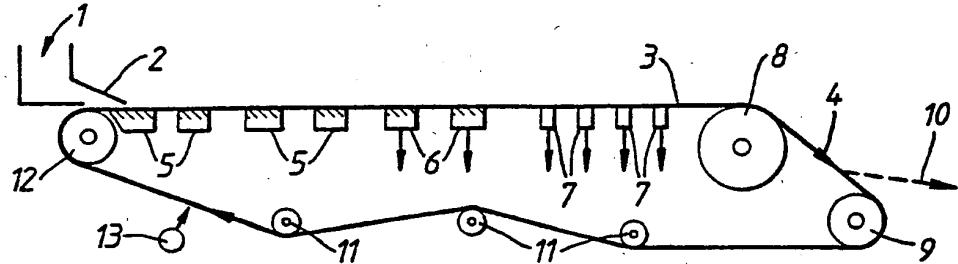


Fig. 1.

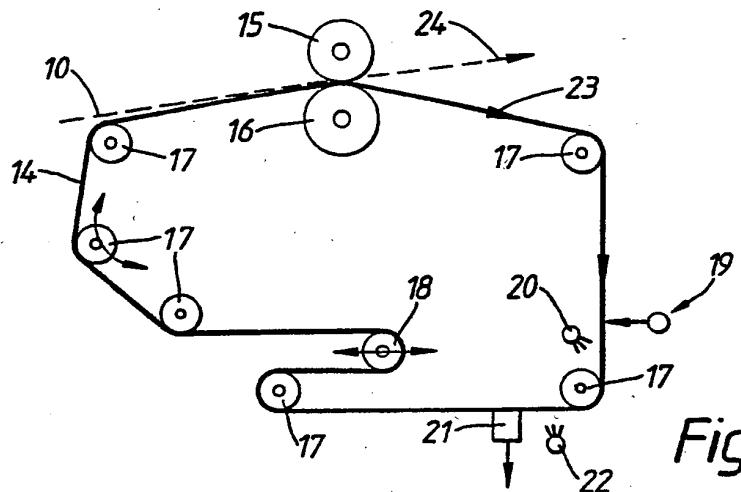


Fig. 2.

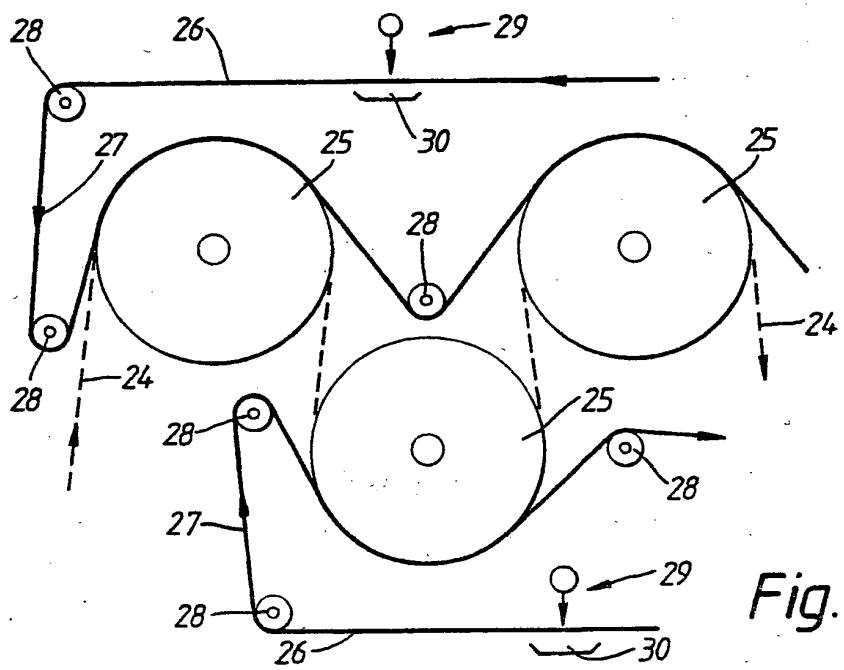


Fig. 3.

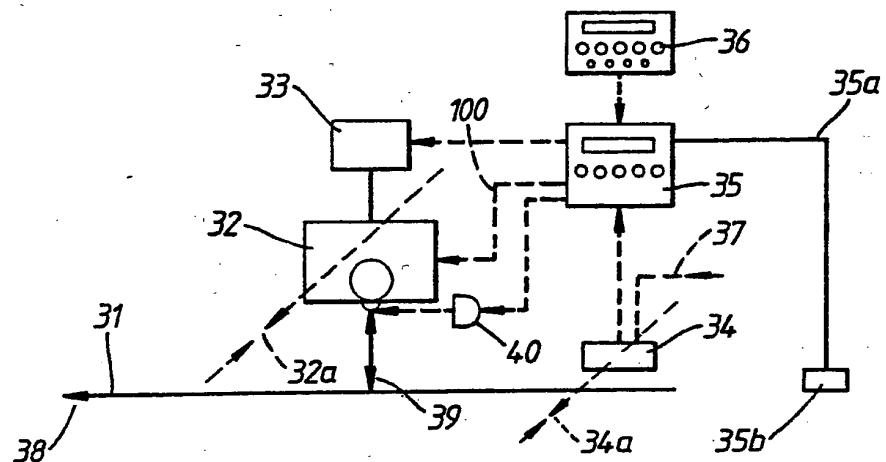


Fig.4.

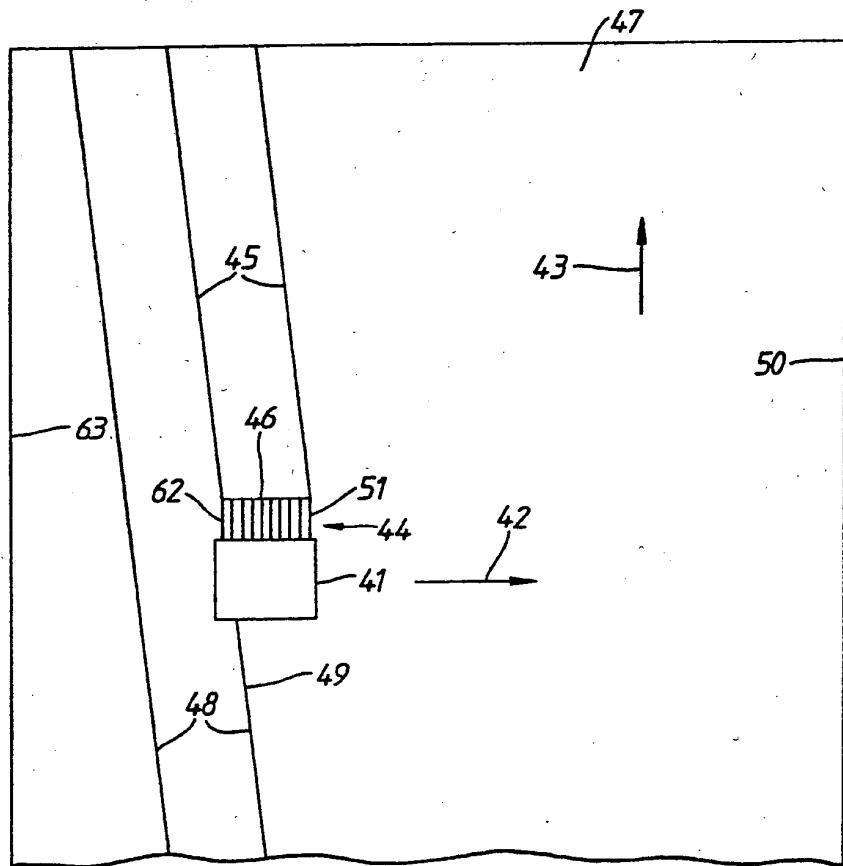


Fig.8.

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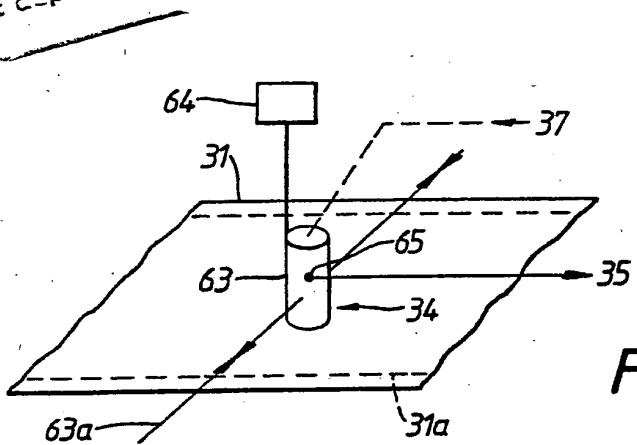


Fig. 5.

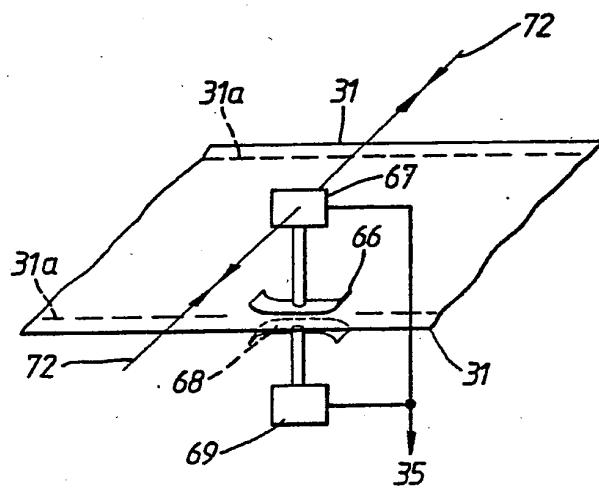


Fig. 6.

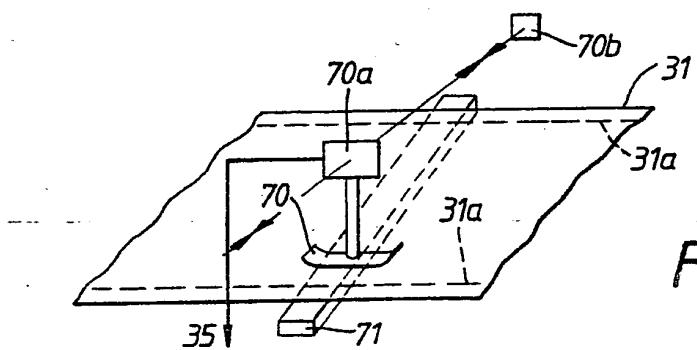


Fig. 7.

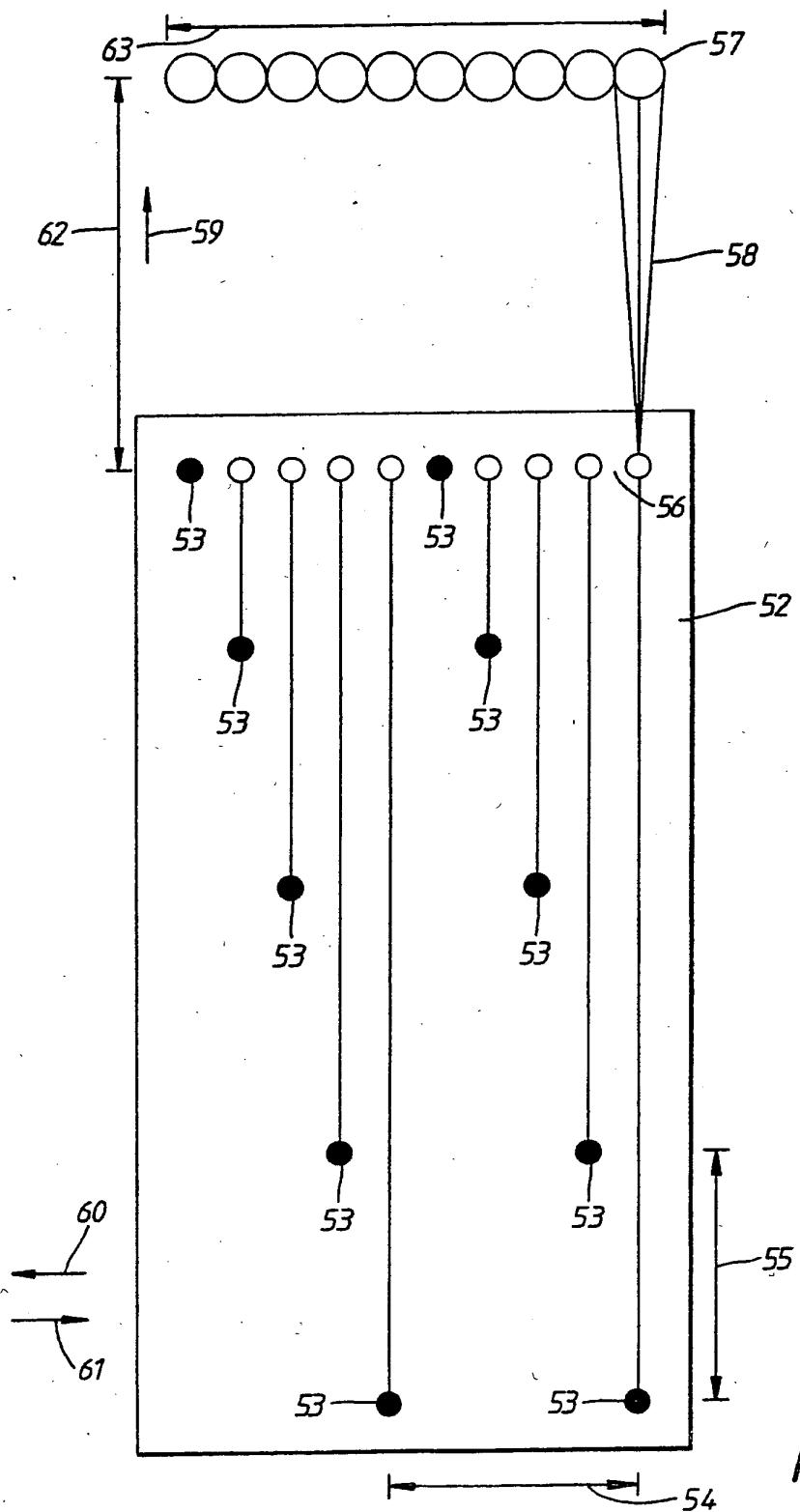


Fig. 9.